

<p align="center">LLNL Environmental Restoration Division Standard Operating Procedure</p>	<p align="center">TITLE: Soil Vapor Surveys</p>
<p>APPROVAL _____ Date _____</p> <p>Environmental Chemistry and Biology Group Leader</p>	<p align="center">PREPARERS: R. Caufield, S. VonderHaar,* J. Pavletich,* J. Iovenitti*</p> <p align="center">REVIEWERS: T. Carlsen, V. Dibley, J. Hoffman*, J. Gardner*, and S. Gregory</p>
<p>APPROVAL _____ Date _____</p> <p>Division Leader</p> <p>CONCURRENCE _____ Date _____</p> <p>QA Implementation Coordinator</p>	<p align="center">PROCEDURE NUMBER: ERD SOP-1.10</p> <p align="center">REVISION: 2</p> <p align="center">EFFECTIVE DATE: December 1, 1995</p> <p align="center">Page 1 of 21</p>

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1.0 PURPOSE

To describe sampling procedures that will ensure the collection of representative samples and accurate analytical measurements of soil vapor from discrete subsurface depths.

2.0 APPLICABILITY

This procedure applies to *in situ* subsurface soil vapor sampling for volatile organic compounds (VOCs) present at depths ranging from just below the ground surface down to approximately 30 feet. The outlined procedures are applicable to surveys conducted at the LLNL Livermore Site and Site 300.

3.0 REFERENCES

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- 3.2 Dresen, M. D., E. M. Nichols, R. O. Devany, D. W. Rice, Jr., F. A. Yukic, G. Howard, P. Cederwall, B. Qualheim, R. S. Lawson, And W. F. Isherwood (1989), *LLNL Ground*

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Water Project Monthly Progress Report—January 1989, Lawrence Livermore National Laboratory, Livermore, Calif. (UCAR-10160-89-2).

- 3.3 Lamarre, A., N. Crow, S. Vonder Haar, W. McIlvride, R. Ferry, J. Pavletich, R. Caufield, E. Anderson, And M. Wade (1989), "Trichloroethylene Contaminant Plume Definition At The Lawrence Livermore National Laboratory Site 300 General Services Area And Adjacent Ranches, Southeast Of Livermore, California," (Abstract) In Trans., American Geophysical Union Annual Meeting Held In San Francisco, 24 October 89.
- 3.4 Silka, L. R. (1988), "Simulation of Vapor Transport Through the Unsaturated Zone—Interpretation of Soil-Gas Surveys," *Ground Water Monitoring Review*, pp. 115-123.
- 3.5 Vonder Haar, S., J. Pavletich, W. McIlvride, and M. Taffet (1989), *Soil Vapor Survey at the LLNL Site 300 General Services Area, Adjacent Portions of the Connolly and Gallo Ranches, and the Site 300 Landfill Pit 6 Area*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-21183), p. 47 plus 1 appendix.
- 3.6 Vonder Haar, S., R. Ferry, and A. Lamarre (1991), *Comparison of Two Soil-Vapor Survey Techniques and Their Relationship to TCE Concentrations in Underlying Ground Water at Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-107360), p. 67 plus 4 appendices.

4.0 DEFINITIONS

4.1 Soil Vapor Survey (SVS)

A technique for the collection and analysis of soil vapor conducted to determine the presence of subsurface contamination of volatile and semivolatile compounds.

4.2 PETREX

PETREX is a patented name used by the Northeast Research Institute for a passive soil vapor collector that utilizes a carbon adsorbent contained in a glass housing that is capable of detecting trace amounts of volatile organic compounds in soil vapor.

5.0 RESPONSIBILITIES

5.1 Division Leader

The Division Leader's responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

5.3 Site Safety Officer (SSO)

Determines the need for protective equipment required to enable the field survey to be conducted in a safe manner.

5.4 SVS Project Coordinator

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The SVS Project Coordinator is responsible for preparing the SVS Sampling Plan, maps, logistics, technician support and line locators coordination. The SVS Project Coordinator is also responsible for ensuring that the Sampling Plan includes the proper QC samples (i.e., trip blanks, 10% of the sample locations performed in duplicate).

5.5 SVS Technician

The SVS technician is responsible for conducting sampling in accordance with this procedure and the sampling plan, conduct all necessary equipment maintenance, and make all required log book entries.

6.0 PROCEDURES

6.1 Discussion

- 6.1.1 Soil vapor surveys (SVSs) are used mainly as a tool to indicate the presence of volatile organic compounds (VOCs) in soil vapor as a result of volatilization from the soil and/or ground water. Two distinct SVS methods are used: the active vacuum induced (AVI) and the passive PETREX collector.
- 6.1.2 AVI can be used to collect and analyze samples obtained from depths ranging from just below the surface to over 60 feet (see Attachment A). Samples are obtained by first driving a sampling probe assembly into the subsurface to the desired depth. The probe consists of a slotted aluminum drive point attached to Teflon tubing which is threaded through linked hollow-stem stainless steel drive rods. Either a trailer mounted hydraulic drill rig or an electric rotary hammer is used to drive the probe to depth. Then, after exposing the slotted portion of the aluminum point, a vacuum apparatus is attached to the Teflon tubing to draw a soil vapor sample to the surface for collection. Samples are analyzed using either a portable gas chromatograph (GC) for individual chemical compound identification and quantification or an organic vapor analyzer (OVA) for a total VOC measurement. This technique provides quantitative contaminant concentrations reported in parts per million (ppm)_{v/v}. Samples may also be sent off site for analysis after collection in an appropriate container.
- 6.1.3 The PETREX passive soil-vapor technique provides a means to collect and detect trace quantities of a broad range of VOCs and semi-volatile organic compounds (SVOCs) near the ground surface (see Attachment B). The PETREX collector consists of a glass tube containing two or three ferromagnetic wires coated with an activated carbon adsorbent. The collector is left in the ground from 1 to 30 days, depending upon the expected VOC concentrations in the soil (loading rates). It is then retrieved and sealed for transportation back to the laboratory for analysis. In the laboratory, the compounds are thermally desorbed from the wire, ionized, separated according to mass, the ion fragments are counted, and the chemicals are identified. This technique provides only qualitative, relative contaminant concentrations, reported as Total Ion Counts (TIC). The TIC is dependent upon the length of time the collector is left in the ground, atmospheric and soil conditions.

6.2 Office Preparation

- 6.2.1 Collect the equipment and materials needed to conduct the survey per Attachment C, Equipment Checklist. Verify the equipment is in working order.

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- 6.2.2 Obtain a soil vapor sampling station location map from the SVS Project Coordinator (see Attachment D of this SOP for a SVS sampling station example). Obtain a logbook from the Document Control Officer per ERD SOP 4.2 "Sample Control and Documentation."
- 6.2.3 Verify with the SVS Project Coordinator that the soil vapor stations have been properly cleared by an underground line locator.
- 6.2.4 Read and understand the site safety plan. Obtain any necessary safety equipment.
- 6.2.5 Review all applicable SOPs.

6.3 Field Preparation

Record required information on the Daily Field Report and the SVS Analytic Data Sheet (see SOP 1.1, "Field Borehole Logging", Borehole/Well Construction Log, Attachment C and Attachment E, SVS Analytic Data Sheet in this SOP). Make appropriate entries into the SVS field logbook.

6.4 AVI SVS Operation

The AVI SVS procedure consists of three major operations: 1) station set-up, 2) sample collection, and 3) sample analysis. Each step has two possible approaches making a total of eight available modes of operation. The mode selection criteria include the specific field conditions and analytical requirements of the particular survey.

6.4.1 AVI Sampling Station Set-Up

A. Drill rig installed SVS station

This method is especially useful for sample depths greater than 5 ft. Generally, a trailer-mounted auger rig is employed to install the sampling probes. However, a full-size drill rig can be used to reach greater depths.

1. Set up the rig at the selected SVS station. Verify the location has been marked as being cleared by the underground utility line locator before proceeding.
2. Drill a borehole within 2 ft of the desired sampling depth. Specific soil conditions may require an adjustment of this measure. Note the borehole depth in the field logbook.
3. Assemble the sampling probe:
 - a. Connect enough lengths of stainless steel drive rods together to reach the desired sample depth. Only use rods which have been decontaminated according to SOP 4.5, "General Equipment Decontamination." Attach the side-port adapter which allows the Teflon tubing to exit the sampling probe assembly.
 - b. Attach an aluminum drive point to a length of Teflon tubing by crimping the top portion of the drive point onto the terminal 1 in. of the tubing. The tubing length should be approximately 3 ft greater than the drive rod length. Use only new aluminum drive points and Teflon tubing at each sample location.

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- c. Thread the Teflon tubing into the bottom end of the drive rod assembly until the aluminum drive point seats into the rod. Assure the other end of the tubing has exited the probe through the adapter at the top of the drive rod assembly.
 4. Place the sample probe into the borehole assuring that the aluminum drive point remains seated inside the drive rod. If it does not, remove the probe from the borehole, reseal the aluminum point, and secure the tubing at the side port adapter with Teflon tape to eliminate slippage; reinstall the probe.
 5. Connect the adapter at the top of the probe to the drill rig drive assembly and hydraulically drive the tip of the sampling probe to the desired depth. Note the final depth in the field logbook.
 6. Expose the slotted portion of the aluminum drive point by hydraulically lifting the drive rods about 2 in. with the drill rig. Ensure the drive point has remained at depth while the rods were lifted. This is accomplished by holding or marking the Teflon tubing and assuring that it slips down into the adapter as the drive rods are being lifted. It is critical to perform this step correctly to obtain a representative sample.
 7. Backfill the borehole with auger cuttings and pack the soil around the drive rods tightly to seal off the hole. If necessary, clamp a vise grip to the drive rod at ground level to keep the rod from slipping back into the hole.
 8. Disconnect the sample probe from the drill rig and remove the sideport adapter. Seal the Teflon tubing's exit point out of the drive rod with Teflon tape to prevent dilution of the soil vapor sample with outside ambient air.
- B. Rotary hammer installed SVS station
- This method is useful in areas that are inaccessible to a drill rig.
1. Set up the rotary hammer equipment at the sampling location placing the generator downwind. Verify the location has been marked as cleared by the underground utility line locator before driving the sampling probe.
 2. If necessary, drill a pilot hole through concrete or asphalt surfaces using the rotary hammer and an auger bit.
 3. To assemble the sampling probe see Section 6.4.1, A-3.
 4. Set the rotary hammer to impact only (rotary drive off) then connect it to the sample probe adapter and place the probe tip into the pilot hole.
 5. Drive the tip of the sampling probe to the desired depth. Note the final depth in the field logbook.
 6. Verify the Teflon tubing has remained connected to the aluminum drive point by gently pulling on the tubing. If it has not, remove the rod and repeat the sample station installation procedure.
 7. Expose the slotted portion of the aluminum drive point by lifting the drive rod about 2 in. with the hydraulic jack. Ensure the drive point has

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remained at depth while the rod was lifted. This is accomplished by holding or marking the Teflon tubing and assuring that it slips down into the adapter as the drive rod is being lifted. It is critical to perform this step correctly in order to obtain a representative sample.

8. Disconnect the sample probe from the rotary hammer and remove the sideport adapter. Seal the Teflon tubing's exit point out of the drive rod with Teflon tape to prevent dilution of the soil vapor sample with outside ambient air.

6.4.2 AVI Sample Collection

A. Direct Sampling

This method is used primarily in conjunction with portable GC analysis. An OVA can also be used but any sample stream flow restriction may cause erroneous readings.

1. Estimate the soil vapor concentration range by connecting an OVM/PID to the Teflon tubing exiting from the sampling probe. This pre-screening will be useful in determining analytical instrument sensitivity settings. Record measurements on the SVS Analytic Data Sheet.
2. Using a 2-in. length of flexible Teflon tubing, attach a low-flow portable vacuum pump to the Teflon tubing assuring a leak-free connection. Use new silicone tubing at each sample location.
3. Start the vacuum pump and adjust sample stream flow to 200 mL/min. Note any flow restrictions in the field logbook and SVS Analytic Data Sheet.
4. Allow a 5-min purge time to remove ambient air from the tubing. (Deep points may need longer purge times.)
5. Using a syringe, collect a sample for direct injection GC analysis by inserting the needle through the silicone tubing, pumping the syringe plunger several times, then slowly drawing in the vapor sample.

B. Vacuum Chamber

This method is used primarily in conjunction with the portable OVA since it eliminates measurement errors caused by sample stream flow restrictions. This method is also useful in collecting samples to be sent to an analytical laboratory for analysis.

1. Install a clean sample bag (Tedlar or equivalent) into a vacuum desiccator which has been modified to allow a sample line to pass through the exterior wall. Verify the sample bag is clean by conducting a "bag blank" test using zero grade air prior to use.
2. Close the vacuum chamber, connect the Teflon sample tubing to the inlet port, and attach the vacuum pump to the outlet.
3. Initiate sample collection by evacuating the internal canister air using the vacuum pump. Adjust the pump flow rate to 200 mL/min.

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4. After an appropriate volume of sample has been collected, close the sample inlet valve, stop the pump, release the vacuum, and remove the sample bag.

6.4.3 AVI Analytical Instrumentation

A. Portable GC

A portable GC is used for analysis when identification and quantification of a sample's constituent compounds is desired. An instrument manufactured by Photovac International Inc. is currently available for this purpose.

1. Operate the Photovac in accordance with SOP 4.10, "Photovac Portable Gas Chromatograph Operating Instructions." Only properly trained personnel should conduct analyses using the Photovac.
2. If possible, set up a field laboratory in a building, trailer, or vehicle to provide stable operating conditions for the Photovac.
3. Using a syringe, obtain a sample for injection into the Photovac GC by either direct inline withdrawal or from a sample bag; both collection techniques are described above in Section 6.4.2, AVI Sample Collection.

B. OVA

The OVA is used when only a total VOC concentration value is necessary. However, a GC column can be installed on some OVAs allowing more sophisticated analyses. The OVA requires less intensive operator training than the Photovac GC.

1. Follow the OVA operating instruction as described in the OVA manual. Only trained OVA operators should use this instrument for analyses.
2. The OVA calibration should be checked a minimum of three times daily with a certified 100 ppm_{v/v} methane standard to test for possible instrument signal drift or malfunction. If necessary, recalibrate the OVA following manufacturer's instructions. Place a sticker with date, time, and calibrator's initials on the OVA and record this information on the SVS Analytic Data Sheet and in the logbook.
3. Samples collected in bags are analyzed by connecting the metal OVA probe to the sample bag and recording the maximum reading. Record the value on the SVS Analytic Data Sheet and note any unusual instrument response.
4. Readings that show an initial upward jump of the scale's pointer followed by a sudden bottoming-out indicate an extinguishing of the detector's flame. This is caused by either extremely high sample concentration or lack of oxygen in the sample; follow the operating instructions to relight the detector.

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6.4.4 AVI SVS Station Breakdown

- A. Remove steel rod from the ground with either the trailer-mounted rig or the hydraulic jack. The stainless steel sampling rods should be cleaned between sites with detergent and hot water as per SOP 4.6.
- B. Remove the Teflon tubing from the ground. If the total VOC soil vapor concentration was unusually high, consult with the SVS Project Coordinator before removing the tubing.
- C. Backfill the hole with native soil. If necessary, cap the hole with asphalt patch or concrete to match the existing surface.
- D. Mark each sample location with a wooden stake, spray-paint or similar identification device. Measure the distance between sample locations using a suitable measuring device and record these distances on a sample location map. Include distance measures to permanent or surveyed landmarks (buildings, monitoring wells, etc.). Orient the map by taking a compass reading. If desired, a survey team may be employed to map the sample locations.

6.5 Passive PETREX SVS Operation

6.5.1 PETREX Installation and Removal

All equipment used for sampler installation and removal should be clean and free of contamination. Care should be taken to prevent cross contamination between sample locations. Always use fresh gloves while handling samplers.

A. Installation

1. Use a shovel in grassy or bare soil areas to dig a 12- to 14-in.-deep hole in the soil. On hard surfaces such as asphalt, concrete, or gravel, use an electric rotary hammer to drill an 18-in. by 1.5-in. hole through the surface.
2. Wrap a PETREX VOC collector with a length of 16-gauge steel wire (for retrieval purposes). To remove possible VOCs, the retrieval wire must be prebaked in an oven for 1.5 h at 150°C.
3. Uncap, invert and place the collector tube at the bottom of the hole. Insert a small plug of aluminum foil 2 to 3 in. below grade, and backfill with the excavated soil. On paved surfaces, cap the hole to grade with a quick-setting cement seal. Make sure no asphalt falls into the hole.
4. Mark the location with its sample identification number using ribbon flagging and a pin flag or wooden stake (bare soil) or spray paint (paved surfaces). Note the sampling locations in the field book and map.
5. Note the soil type, relative moisture, and any evidence of subsurface pipes or possible VOC sources in the field logbook.

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B. Retrieval

1. If possible, retrieve samplers in the order they were installed. This measure ensures uniform field exposure and is especially important in larger surveys.
2. On arrival at each sampling location, place one collector cap (with clean, black viton gasket in place) and a handwipe within easy reach.
3. Excavate the collectors, minimizing disturbance of the contents. Maintain the collector in an inverted position, and handle it with a clean pair of gloves or hands free of potential accumulations of volatile materials (oils, pine tar, etc.). Cut off any retrieval wire.
4. Thoroughly clean soil away from the threads and lip of the bottle with a clean handwipe. Screw the cap on firmly until the lip of the tube seals against the gasket at the base of the cap. Visually inspect the contact between the tube and gasket to ensure that the seal is uniform and unobstructed.
5. If the mouth of the collector is clogged with soil when it is first removed from the borehole, tap the collector gently. If the soil does not shake loose, gently dig out the plug without disturbing the wire. Then, quickly wipe off the threads and lip before screwing on the cap.
6. If the sampler breaks during retrieval, transfer the wires from the broken tube (with forceps) to a clean empty PETREX tube. Make note of this in field notes and on the collector submittal form. Instruct Data Management to flag the reported result as being questionable.
7. Affix a self-adhesive label pre-marked with the appropriate sample identification number to the clean, dry, upper surface of the PETREX cap as soon as the collector is retrieved and sealed. Underline the number written on the label.
8. Ensure that the exterior of the tube is relatively clean of sand, clay, water, and oils, etc. and place the sealed collector into the air-tight plastic bag with the others.
9. After retrieval, check off the location on the map, and mark it down with any comments in the logbook. Measure the distance between sample locations using a suitable measuring device and record these distances on a sample location map. Include distance measures to permanent or surveyed landmarks (buildings, monitoring wells, etc.). Orient the map by taking a compass reading. If desired, a survey team may be employed to map the sample locations.
10. Backfill and cover the borehole. Mark the location with a labeled wooden stake or spray paint. If necessary, cap the hole with asphalt patch or concrete to match the existing surface.

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6.5.2. Time Calibration Tests

Time calibration tests are used to determine the VOC loading rates of the PETREX collectors from the soil vapor. They are required when no previous data exists. The collectors' loading rates depend upon concentration and depth of contaminants, as well as the type of contaminated media (soil or ground water).

- A. Choose a minimum of two additional locations per study area for the time-calibration test. Install two collectors in each location per Section 6.5.1A.
- B. After 7 days, retrieve a set of calibration collectors (as described in Section 6.5.1B) and send to the analytical laboratory for analysis. Select collector locations that are near the suspected VOC plume(s).
- C. The results from the first week of soil-vapor exposure typically provides adequate information on ion count responses to determine the optimum survey duration. An 18-day SVS period is typical.
- D. If necessary, the second set of time-calibration collectors can be sent later (i.e., 14 days) for further refinement of the collection time.

6.5.3. Shipping PETREX Samples

- A. Complete a sample submittal form and Chain-of-Custody (CoC) form when all survey collectors have been retrieved. Include forms with the collectors being shipped. Prepare necessary shipping documents.
- B. Ship all samplers to Northeast Research Institute (NERI) in Lakewood, Colorado. Instruct shipping to use only bubble wrap for packing; other packing materials may contaminate samplers.
- C. Ship samplers via overnight courier to avoid subjecting them to uncontrolled, possibly contaminating, environments for greater than 24 h. If the weekend is approaching and overnight shipping entails an extra day holdover, do not ship the samples until the beginning of the week. In the interim, store the packaged collectors in a clean environment.
- D. Include two unopened travel blanks for every 25 PETREX collectors shipped.

6.6 Post Operation

- 6.6.1 Decontaminate (SOP 4.6) and store equipment properly.
- 6.6.2 Review logbooks and field forms for completeness and accuracy per SOP 4.2, "Sample Control and Documentation."

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7.0 QUALITY ASSURANCE RECORDS

- 7.1 Final Analytical Data (either in ppm_{v/v} or ion counts).
- 7.2 Field Logbooks
- 7.3 Daily Field Report
- 7.4 SVS Analytical Data Sheet
- 7.5 Chain-of-Custody forms

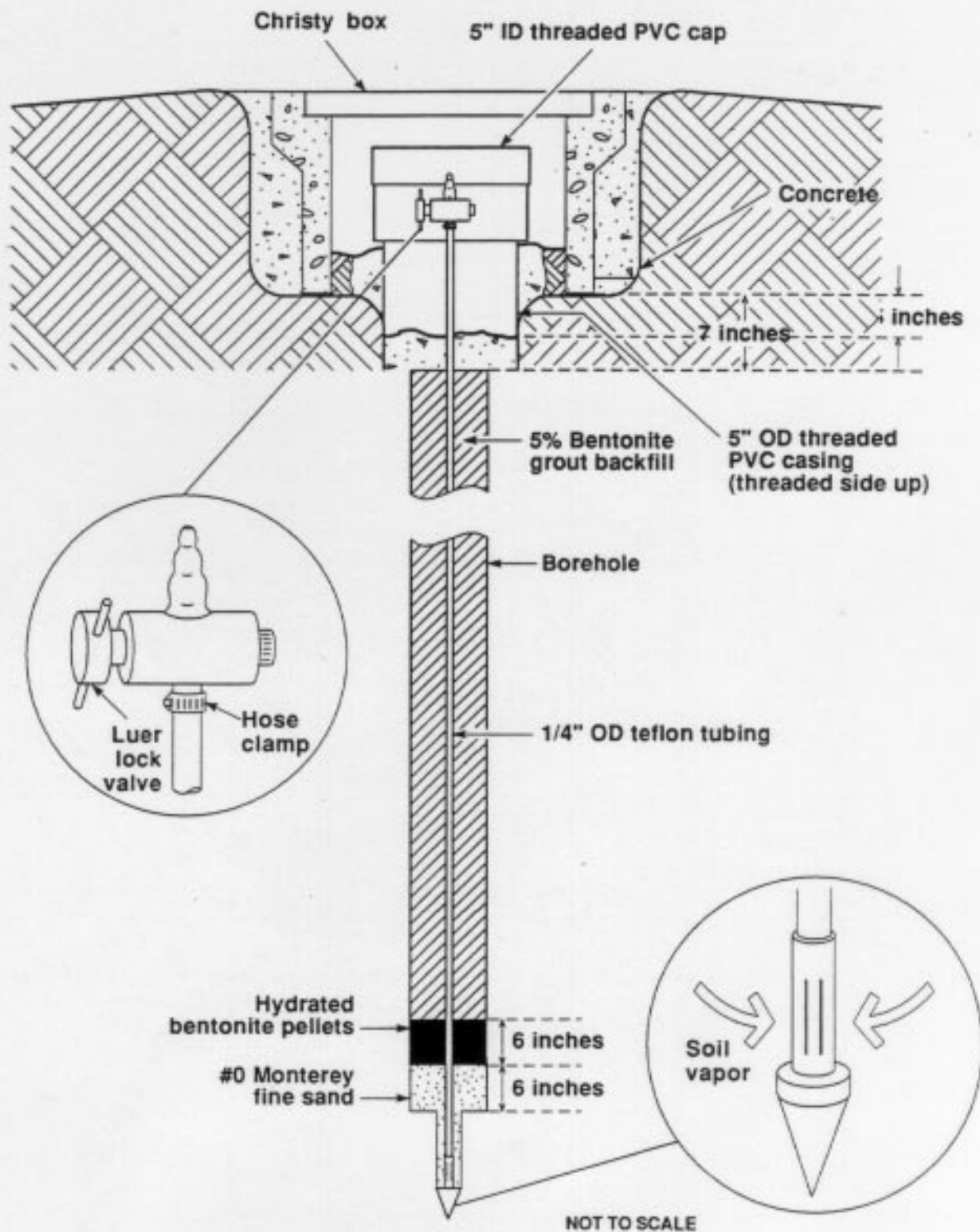
8.0 ATTACHMENTS

- Attachment A—Figure of a Dedicated Soil Vapor Monitor Point used for AVI
- Attachment B—Figure of a PETREX Passive Soil-vapor Collector
- Attachment C—Equipment Checklist
- Attachment D—SVS Sampling Station
- Attachment E—SVS Analytical Data Sheet

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Attachment A

Figure of a Dedicated Soil Vapor Monitor Point used for AVI



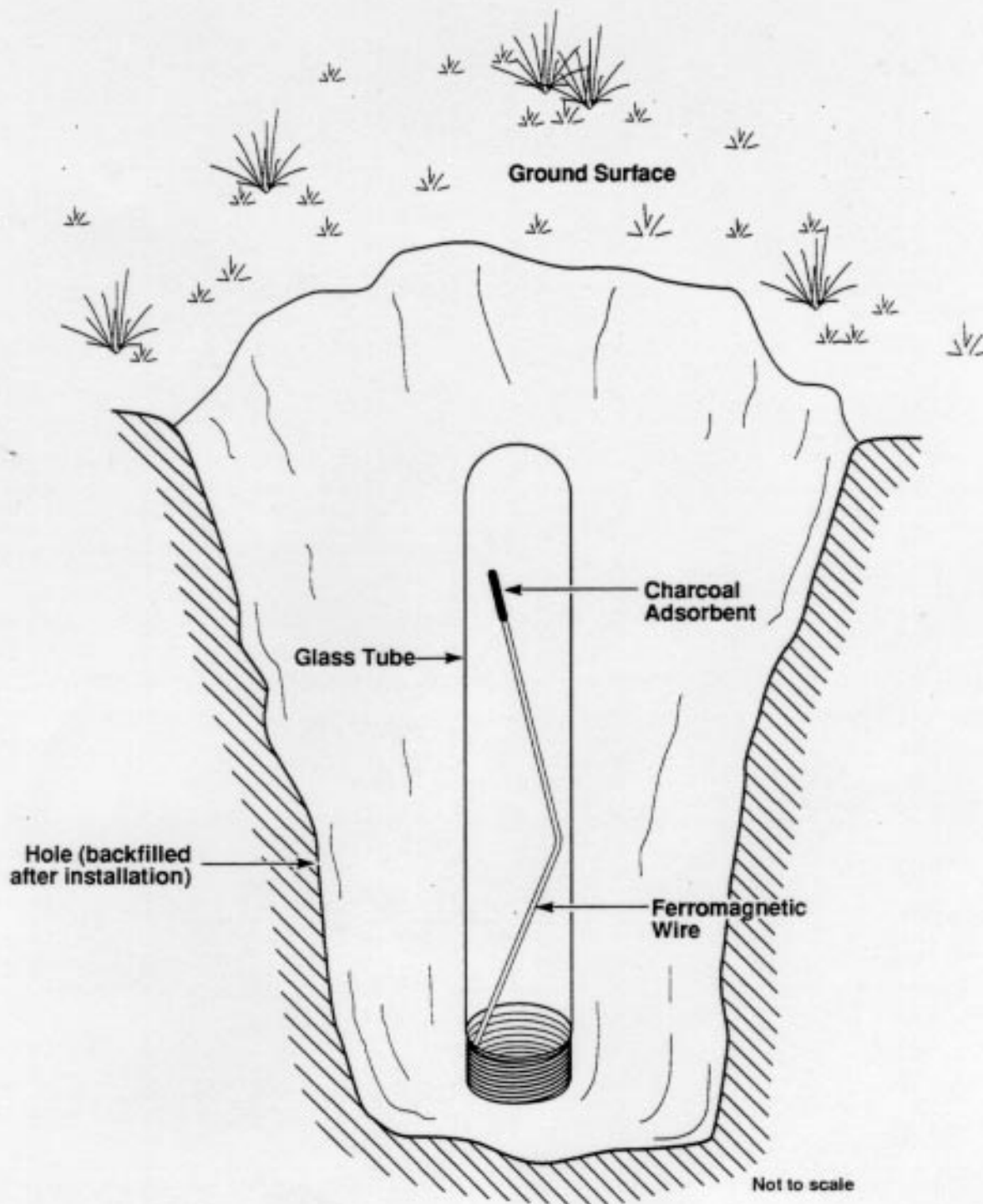
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Attachment A. Dedicated soil vapor monitor point used for AVI.

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Attachment B

Figure of a PETREX Passive Soil-Vapor Collector



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Attachment B. Petrex passive soil-vapor collector.

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Attachment C

Equipment Checklist

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EQUIPMENT CHECKLIST

General Materials

- ☐ Aluminum foil
- ☐ Broom and dust pan
- ☐ Chalk
- ☐ Compass
- ☐ Container for H₂O
- ☐ Ear plugs
- ☐ Extension cord
- ☐ First aid kit
- ☐ Flashlight
- ☐ Garbage bags
- ☐ Geologist's hammer
- ☐ Work gloves and sampling gloves
- ☐ Handiwipes
- ☐ Lab soap
- ☐ Logbook
- ☐ Maps (site and sample location)
- ☐ Measuring tape and/or wheel
- ☐ Mixing bucket
- ☐ Notebook and clipboard
- ☐ Pens
- ☐ Personal protective equipment
- ☐ Pin flags or wooden stakes
- ☐ Pliers and wire snips
- ☐ Poly rope and/or HIP chain
- ☐ Quick-plug cement
- ☐ Ribbon flagging
- ☐ Engineer's scale and calculator
- ☐ Safety glasses
- ☐ Scissors
- ☐ Scrub brush
- ☐ Shovel
- ☐ Spray paint
- ☐ Tool box
- ☐ Trowel and spatula
- ☐ Utility bucket
- ☐ Vice grips

AVI SVS Materials

- ☐ 3/4-5/8-in.-diam. stainless steel drive rods
- ☐ Aluminum drive points
- ☐ Teflon tubing
- ☐ Sideport tubing exit adapter
- ☐ Teflon tape
- ☐ Low-flow portable vacuum pump
- ☐ Analytic data sheets
- ☐ 1L Tedlar bags
- ☐ Hot plate

Photovac specific materials:

- ☐ Photovac GC and accessory equipment
- ☐ Zero-grade air
- ☐ Gas-tight syringes, assorted sizes
- ☐ 1-liter mega syringe
- ☐ Calibration gas

OVA specific materials:

- ☐ OVA
- ☐ Hydrogen gas (for detector)
- ☐ Modified desiccator/pump assembly
- ☐ Methane calibration gas
- ☐ Sample bags

Drill rig specific materials:

- ☐ Trailer mounted or full-size drill rig
- ☐ Augers and supporting equipment

Rotary hammer specific materials:

- ☐ Rotary hammer (or jack-hammer)
- ☐ Hydraulic jack and rod connector
- ☐ Hand auger
- ☐ Generator

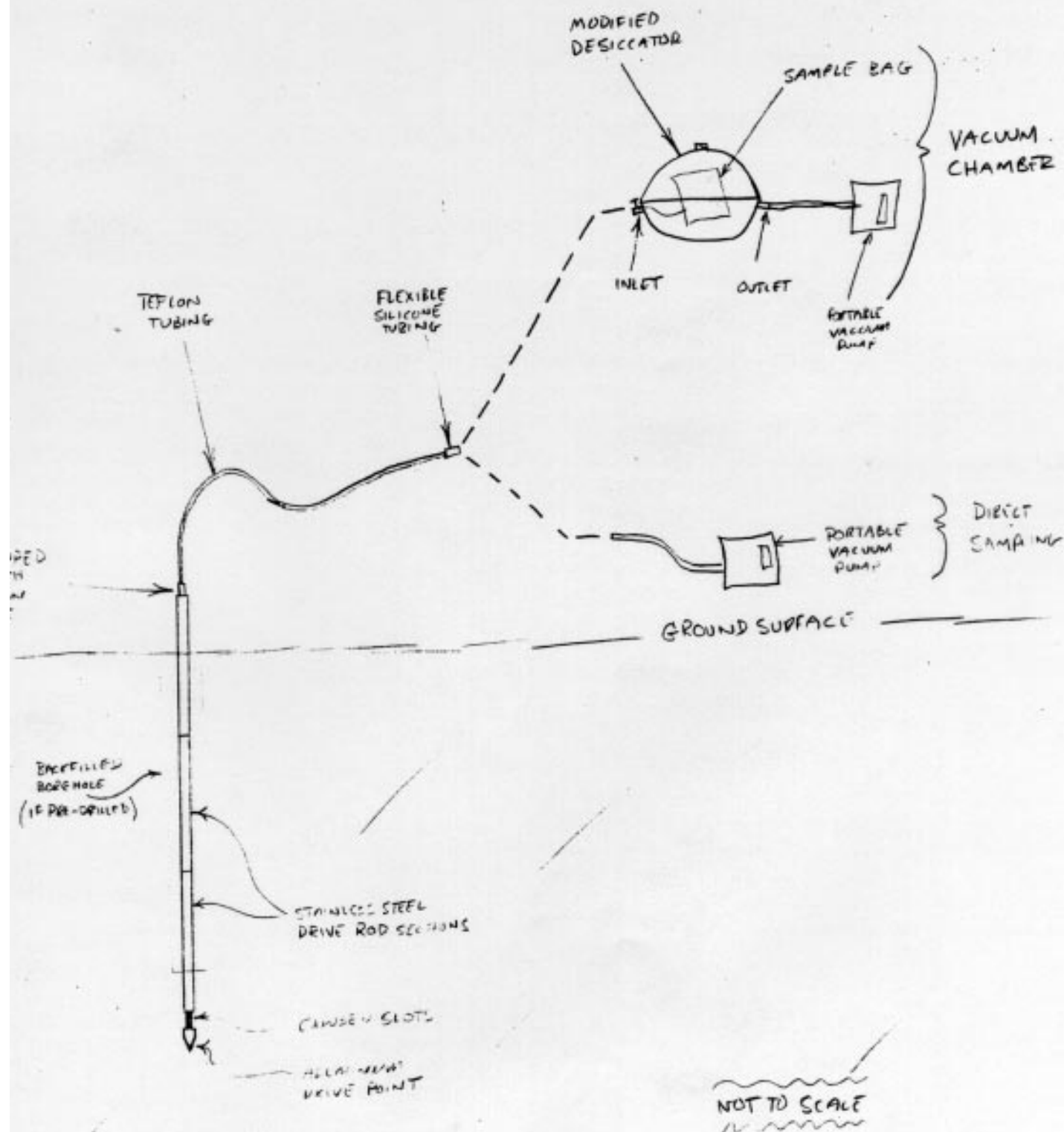
PETREX Materials

- ☐ Air-tight plastic bags
- ☐ Bubble wrap
- ☐ Chain-of-Custody forms
- ☐ Chisel
- ☐ Cooler
- ☐ Coring shovel
- ☐ Coring tube with 8 lb sledge hammer
- ☐ Dolly
- ☐ Duffel bag(s) (carry-on size)
- ☐ Extra Petrex tubes (empty) with caps
- ☐ Clean forceps
- ☐ Generator (plus gasoline container)
- ☐ Hammer drill (plus 2 bits)
- ☐ Knee pads
- ☐ Labels
- ☐ Machete
- ☐ Packing tape
- ☐ PETREX collectors with caps
- ☐ 15 time tests, 5 blanks, extras
- ☐ Pliers (needle nose)
- ☐ Retrieval wire (baked)
- ☐ Screwdriver (large flat)
- ☐ Spatula
- ☐ Time test/retrieval protocol sheet
- ☐ Tongs
- ☐ Wire snips
- ☐ Wooden dowel

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Attachment D

SVS Sampling Station



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Attachment E

SVS Analytic Data Sheet—OVA

SVS Analytic Data Sheet -- OVA

Survey Area _____

Survey Date _____

Analyst Name _____

[illegible]